



AN INVESTIGATION INTO THE INTRODUCTION OF ARTIFICIAL INTELLIGENCE IN THE MEDICAL CURRICULUM FOR HEALTHCARE PROFESSIONALS IN DEVELOPING COUNTRIES SUCH AS INDIA

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ABSTRACT

Artificial intelligence (AI) has become an irreplaceable part of most people's lives, with far-reaching impacts ranging from engineering, Robotics, Navigation, facial recognition, Agriculture, gaming etc. Still, perhaps its most beneficial application is in the field of medicine and healthcare. Healthcare is an ever-evolving and improving field dedicated to helping people with their mental and physical well-being. It is in the true sense that it touches human lives, gives way to precision medicine and surgery, preventive health and increases the longevity and well-being of human life. The introduction of Artificial intelligence has revolutionised the industry in unimaginable ways. It is already being used to make clinical diagnoses, reports various investigations, assist in surgery and organise large amounts of data into simpler digestible chunks. However, despite its importance, it has still not found its place in the Indian medical education curriculum. This report analyses the need for the incorporation of AI as a part of the Indian Medical Educational system and provides recommendations on the process of its assimilation.

KEYWORDS: Artificial Intelligence, Indian Medical Curriculum, MBBS, MD, MS.

INTRODUCTION

This commentary examines the current state of medical education in India and explores the potential inclusion of Artificial Intelligence (AI) as a subject in the medical curriculum. While the idea may initially seem unconventional, the utilization of AI in the medical field has experienced a significant surge in recent years. To assess the feasibility and relevance of introducing AI in medicine, this research article gathers insights from a diverse group of participants, including over 150 doctors and 30 prospective medical school students. Their views and thoughts on the topic are compiled and analyzed, shedding light on the potential implications and benefits of incorporating AI into the medical curriculum, particularly in developing countries like India.

Trends in Healthcare

There has been a notable rise in healthcare expenditure in India in recent years, largely attributed to the impact of the COVID-19 pandemic. The government has recognized the significance of robust medical infrastructure, leading to increased spending and concerted efforts to establish new medical schools, and hospitals, and upgrade existing facilities. The focus has also been on improving the doctor-patient ratio in the country. In the financial year 2023, the government allocated 2.2% of its GDP towards healthcare expenditure, a significant increase from 1.6% in 2021. This translates to a total investment of approximately Rupees 89155 Crores or 10.8 billion USD [1].

In parallel, investment in Artificial Intelligence (AI) in medicine has witnessed substantial growth, experiencing a surge of over 109% since 2018. It is projected to reach 11.5 billion USD by 2025, contributing to a trillion-dollar boost in the Indian economy by 2035 [2].

The medical education landscape has also undergone recent transformations, influenced by the National Medical Commission's revised policies. One noteworthy addition is the implementation of a standardized exam called the National Exit Test (NEXT) after the completion of the initial six years of medical school [3]. Additionally, the 2021 NMC bill mandates a three-month training program for postgraduate students in district hospitals. Another significant development is the introduction of competency-based medical education (CBME) by the NMC, emphasizing the holistic growth of medical students and enhancing their computer skills.

The Use & Need of AI in Medicine

Is there a need, and is this the right time to introduce AI in healthcare? To answer this question a survey was conducted for the purpose of this study.

In the survey, 123 doctors were consulted and were asked how frequently they use AI in their work. 52% responded that they frequently used AI. They were further asked to give examples of where they use AI. A few examples are shared below.

1. **CAD MAMMOGRAPHY** - Computer-aided diagnosis (CAD) has been a popular area of research and development in the past few decades. In CAD, machine learning methods and multidisciplinary knowledge and techniques are used to analyse mammograms. The preliminary results are used to assist radiologists in their decision-making process and create a final report.[3]

2. **CORONARY CALCIUM SCORING USING GPT-3** - It calculates the burden of the calcified plaques in the coronary arteries - the vessels to the heart. It is a marker for Coronary Artery Disease and thus a risk of heart attacks. In a nutshell, it helps identify patients at risk of heart attacks and early initiation of medication to reduce their risk.
3. **ECG** - The Echocardiogram test uses inbuilt AI and machine learning to record the heart's electrical activities. Chest X-ray and CT Brain reporting, lung nodule detection on CT, and radionics are a few other such examples.

There has been an increase in the usage of Artificial Intelligence in healthcare throughout the world. Not only has its presence substantially simplified the lives of healthcare practitioners, but it has also helped them diagnose diseases in patients, report scans and perform tasks more accurately and efficiently by performing robotic-assisted surgeries

Current Situation of Medical Colleges in India

The journey of a student in the field of medicine, from the initial years of schooling to achieving specialization, is a demanding and lengthy process spanning approximately 12-15 years. In India, this process consists of several distinct steps. After completing their XII class, students undergo the National Eligibility cum Entrance Test (NEET), an external examination that assesses their eligibility for admission into various medical programs across the country. NEET is a subjective paper lasting three hours and twenty minutes. Based on their performance in NEET, students are selected for different medical programs.

The undergraduate degree in medicine, known as MBBS, extends for six years, including a one-year internship. Upon successful completion, students are awarded their doctorates. Subsequently, doctors choose to specialize in a specific field, pursuing either an MD (Doctor of Medicine) or MS (Master of Surgery) degree, depending on their chosen medical or surgical field of specialization. Furthermore, doctors can opt for further specialization or sub-specialization through programs such as DM (Doctorate of Medicine), MCH (Master of Chirurgery), or fellowship programs.

Presently, there is minimal incorporation of Artificial Intelligence (AI) and Machine Learning (ML) into medical courses in India. To gauge the need for additional knowledge in AI among healthcare practitioners, we conducted surveys, the details of which are provided below.

Methodology

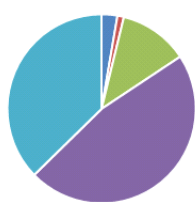
Participants: Two surveys were conducted as part of this study. In the first survey, 185 doctors were selected as participants. They were asked a series of questions regarding their knowledge of AI in healthcare. The second survey involved upcoming medical students who are expected to appear for the NEET examination within the next 1-2 years. These students were surveyed to gather their expectations and thoughts about the growing intersection of Medicine and Computer Science.

First Survey: To ensure the comprehensiveness and accuracy of the results, doctors from various hospitals and specializations were included in the survey.

Efforts were made to have an equal representation of responses from both Government Hospitals and Private hospitals, thereby minimizing any potential bias in the survey. The survey was conducted online, and the participants were asked the following questions.

1. What is your name (short answer question)
2. Which Institute are you currently placed at? (Short answer question)
3. What is your speciality? (Short answer question)
4. How frequently do you use AI in your field (MCQ type)
 - a. Frequently
 - b. Rarely
 - c. Sometimes
5. If you do, kindly give an example (short answer)
6. Do you feel that your training in AI has been sufficient? (MCQ type)
 - a. Yes
 - b. No
7. When companies come to you with their software, do you feel a mismatch between the type of software that you need and the type of software that is offered? (MCQ type)
 - a. Yes
 - b. No
8. Would it be beneficial if AI theory and its applications were included as a part of the Indian curriculum for medicine, given its increased usage? (MCQ type)
 - a. Strongly disagree
 - b. Disagree
 - c. Neutral
 - d. Agree
 - e. Strongly Agree
9. When should AI be introduced in medicine (MCQ type)
 - a. During MBBS
 - b. During MD
 - c. During NEET preparation
 - d. In the form of optional training camps during the MBBS/MD degree
 - e. Not required
10. Do you have any other suggestions related to the topic (short answer)

Would it be beneficial if AI theory and its applications were included as a part of the curriculum as a part of the Indian curriculum for medicine given its increased usage



Strongly disagree Disagree Neutral Agree Strongly agree

Second Survey: The second survey had a smaller sample size of 20 NEET students; these students were 16-17-year-old students who are currently studying in 11th and 12th grade. They shared that their lack of knowledge of Artificial intelligence was a source of anxiety for them. They were asked the following questions.

1. What is your name (short answer question)
2. As an upcoming medical student, do you feel that you have enough information about where and how AI is used in medicine (MCQ type)
 - a. Yes
 - b. No
3. Do you feel it would be helpful if the basics of AI theory were taught during your medical years? (MCQ type)
 - a. Yes
 - b. No
4. When should AI learning be a part of medicine? (MCQ type)
 - a. During MBBS
 - b. During MD
 - c. During NEET preparation
 - d. In the form of optional training camps during the MBBS/MD degree
5. Do you have any other suggestions about the basics of AI being introduced in medicine (short answer)

Results & Inferences from the Survey

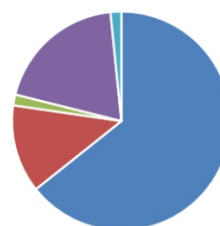
Both surveys gave a clear indication of the willingness and urge of doctors and students to be introduced to AI during their medical school. It was observed that 93.5% of people felt that their training in AI has not been sufficient even though almost half of them already use it as a part of their job. 93.8% of the students and 84.4% of the doctors we questioned agreed that incorporating courses about AI pertaining to their field is important in today's day and age. 81.2% of the students even claimed that they felt that the current education curriculum would not prepare them well enough to be able to utilise complex systems of machine learning and Artificial Intelligence. This fear was further validated by the

doctors, who almost unanimously agreed that their current training did not equip them with the required technical skill sets to operate, create, and navigate such machines.

Perhaps the single most interesting finding in this paper was that around 80% of doctors felt a mismatch between the type of software that was being made and the type of software they required. Given the extensive training doctors undergo, they are a lot more equipped to identify problems and solutions in their field than software engineers. Doctors face problems daily which can be rectified if proper machine-learning models are made. Yet, a major reason why there is a delay in this technology is a lack of understanding between doctors and engineers. If doctors are trained in AI, they will be an inherent part of designing and creating their own software and also bridge the gap between various STEM subjects to a large extent.

Recommendations

When should AI be introduced in medicine



During MBBS During MD During NEET Prep As optional training during MBBS/ MD training Not needed

Upon analysis, it was observed that both students and doctors expressed similar recommendations. They agreed that the theory and principles of artificial intelligence should be incorporated as a subject in the MBBS curriculum. This would involve teaching students the theory and applications of AI without requiring them to learn actual coding. Additionally, it was suggested that during MD training courses, there should be an optional opportunity for students to learn the basics of coding. This would enable them to engage in interdisciplinary projects and collaborate with students from other fields for their undergraduate and postgraduate projects. While interdisciplinary projects are prevalent in Western countries, a change in the educational curriculum can facilitate their implementation in STEM fields in India.

However, it is important to acknowledge that implementing these changes cannot be accomplished overnight. Many medical colleges in India are currently facing challenges, including a lack of basic technologies. In light of these circumstances, several solutions have been proposed to address these issues.

1. The addition of a computer language in the MBBS syllabus for the first and second year can be done in collaboration with nearby engineering colleges [4]
2. Introducing students to the applications of AI in the third year of their MBBS.
3. These courses can be modelled on the basis of courses available on Coursera by reputable institutes.
4. Adding a final project that can be done in collaboration with other majors, such as software and electrical engineering.
5. Bridge course for those who may want to pursue a master's in AI

Further Studies

In order to provide a comprehensive analysis, future studies should aim to include the perspectives of current medical students, in addition to doctors and upcoming medical students. This will allow for a more holistic understanding of the opinions and needs of individuals at different stages of their medical education.

The primary focus of this study is to assess the necessity of AI education for medical students in the Indian context and explore potential approaches to providing access to such education. It is crucial to determine what aspects of AI should be taught to medical students and what should be excluded.

Moreover, our surveys revealed an interesting finding that extends beyond the medical field: while software engineers may create AI programs, they may not always be the most suitable individuals to design such programs. Those who have studied and specialized in AI and related fields possess a deeper understanding and knowledge of the subject matter. Therefore, it is essential to delve into discussions and research on the most appropriate individuals to design machine learning (ML) and AI systems in the future.

Conclusion

In conclusion, India has made significant strides in restructuring and modernizing its medical education policy in recent years. The National Medical Commission (NMC) has made commendable efforts in this regard. However,

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